

UK Patent Application (12) GB 2 273 407 (13) A

(43) Date of A Publication 15.06.1994

(21) Application No 8600583.2

(22) Date of Filing 10.01.1986

(30) Priority Data

(31) 8500728

(32) 11.01.1985

(33) GB

(51) INT CL⁵
H04B 10/12 10/08

(52) UK CL (Edition M)
H4B BK12C BK8B

(56) Documents Cited
WO 82/02632 A1

(58) Field of Search
UK CL (Edition H) H4B
INT CL⁴ H04B

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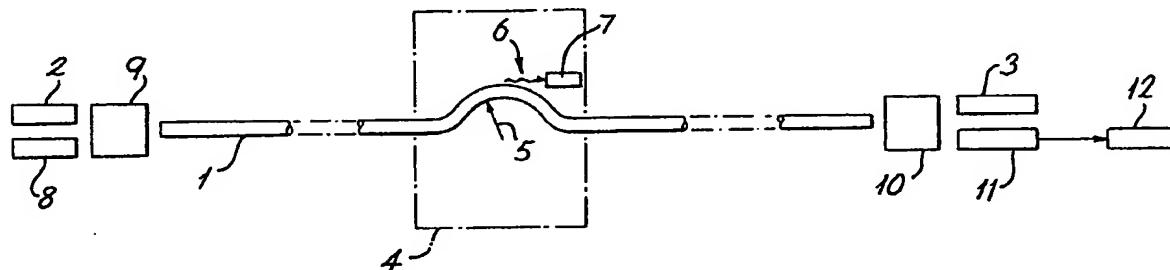
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(54) Monitoring of optical communications fibres

(57) In a device for detecting the presence of a bend (5) used for the illicit tapping of communications through an optical fibre (1) a pilot beam of different frequency from the communications beam is generated by a source (8) and the relative attenuation of the two beams is measured at the receiving end. A change indicates the presence of a bend.



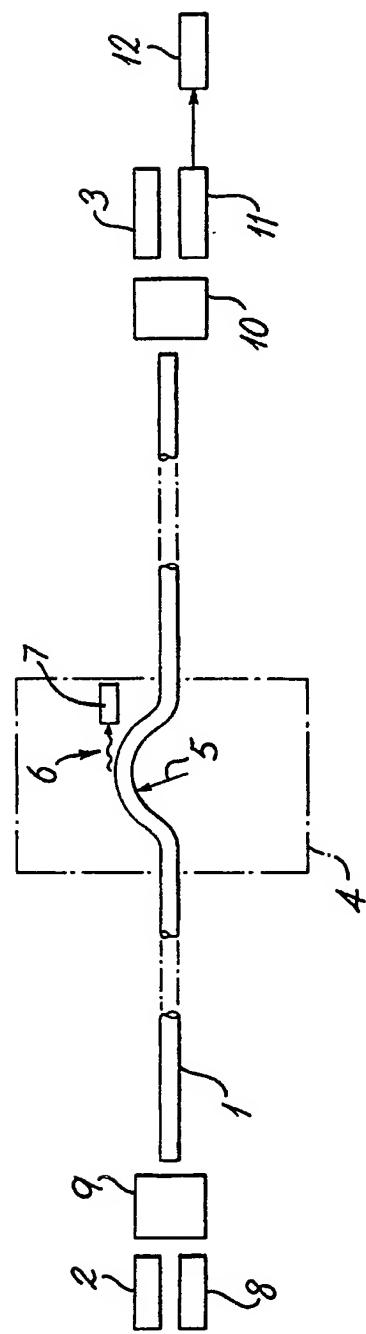
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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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MONITORING OF OPTICAL COMMUNICATIONS FIBRES

This invention relates to communications by optical fibre light guides and, in particular, to methods of and apparatus for the detection of illicit tapping of communications links using such fibres.

05 The term light in this specification includes ultra violet, visible and infra-red electromagnetic radiation.

Communication by means of optical fibre light guides involves the transmission of modulated light from one end of the fibre to the other. It is possible to break into this communications path 10 by introducing a bend into the fibre. A small fraction of the transmitted light leaves the light guide at the bend and can be detected with suitable apparatus, thereby intercepting the message being transmitted. A loss of as little as one per cent of the light in transit is sufficient to give reliable detection. In 15 order to determine whether or not tapping is taking place, it is necessary to be able to detect losses of this magnitude in the transmitted power in an environment which includes variations in transmitted power, coupling efficiency at repeater stations and receiver noise.

20 Accordingly, the present invention provides a method of detecting the presence of a bend in an optical communications fibre comprising transmitting a pilot beam of light of a frequency different from that used for communication and measuring the relative attenuation of said pilot beam.

25 An embodiment of the invention will now be described by way of example with reference to the accompanying drawing in which:-

Figure 1 shows schematically a device for security monitoring.

Referring now to the drawing an optical communications fibre 1 acts as a path for the communications beam transmitted between a 30 source 2 and a receiver 3. At some point on the fibre is an illicit tapping point 4 with an induced bend 5 of radius R at which escaping light 6 is detected by a photo-sensor 7. A further transmitter 8 generates the pilot beam of wavelength different

from the wavelength of the radiation used for the communications beam. Light from both transmitters 2, 8 is injected into the optical fibre by means of a launching device 9. At the remote end of the fibre a wavelength separating device 10 splits the light 05 into its two components and passes them to separate receivers. The auxiliary light receiver 11 is coupled to monitor and alarm 12, which raises an alarm when the pilot beam power decreases as a result of an illicit bend in the fibre.

With a single-mode fibre (or multi-mode fibre having only a 10 few modes), for a wavelength of 632 mm, a power loss of 0.1 is obtained by bending the fibre to a radius of 9 mm. At 790 mm, the power loss at a bend of this radius is 33%, making illicit tapping by fibre bending readily detectable by simply monitoring the transmitted power level of the pilot beam.

15 As a modification of the invention, the communications fibre may be arranged with the monitoring apparatus at the same end as the receiving apparatus. In this case, the main and pilot beams will be transmitted back to the source end for monitoring.

CLAIMS

1. A method of detecting the presence of a bend in an optical communications fibre comprising transmitting a pilot beam of light of a frequency different from that used for communication and measuring the relative attenuation of said pilot beam.
- 05 2. A method of detecting the presence of a bend in an optical communications fibre comprising transmitting a pilot beam of light of lower frequency from that used for communication and measuring the relative attenuation of said pilot beam.
- 10 3. A method of detecting the presence of a bend in an optical communication fibre as claimed in either Claim 1 or Claim 2 wherein the relative attenuation is monitored by measuring it at different times.
- 15 4. Apparatus for detecting the presence of a bend in an optical communications fibre comprising means for generating a pilot beam of different frequency from that of the main beam used for communication and means for measuring the relative attenuation of the two beams after transmission through the fibre.

Amendments to the claims have been filed as follows

CLAIMS

1. A method of detecting the presence of a bend in an optical communications fibre comprising transmitting a pilot beam of light of a frequency sufficiently different from that used for communication that its attenuation due to the presence of a bend
05 in the fibre is measurably different from and greater than the attenuation of the communication beam due to said bend and measuring the attenuation of said pilot beam relative the attenuation of the communication beam.
2. A method of detecting the presence of a bend in an optical
10 communications fibre comprising transmitting a pilot beam of light of lower frequency from that used for communication and measuring the relative attenuation of said pilot beam.
3. A method of detecting the presence of a bend in an optical communication fibre as claimed in either Claim 1 or Claim 2
15 wherein the relative attenuation is monitored by measuring it at different times.
4. Apparatus for monitoring optical communications in accordance with the method of any one of the preceding claims substantially as herein described with reference to and as shown in the accompanying drawing.

FIELD OF SEARCH: The search has been conducted through the relevant published UK patent specifications and applications, and applications published under the European Patent Convention and the Patent Co-operation Treaty (and such other documents as may be mentioned below) in the following subject-matter areas:-

UK Classification H4B

(Collections other than UK, EP & PCT:) Selected US specifications in IPC subclass H04B

DOCUMENTS IDENTIFIED BY THE EXAMINER (NB In accordance with Section 17(5), the list of documents below may include only those considered by the examiner to be the most relevant of those lying within the field (and extent) of search)

Category	Identity of document and relevant passages	Relevant to claim(s)
X	WO-A1-82/02632 (Western Electric) (cf page 11 lines 27-37)	4

CATEGORY OF CITED DOCUMENTS

X relevant if taken alone
Y relevant if combined with another cited document
P document published on or after the declared priority date but before the filing date of the present application
E patent document published on or after, but with priority date earlier than, the filing date of the present application

Search examiner

T BERRY

Date of search

6 July 1986

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